A WINDOW ON THE FUTURE: A VIEW OF EDUCATION AND EDUCATIONAL FACILITIES

A paper designed to generate discussion about educational facilities for the future at the 63rd Annual Conference of the Council of Educational Facility Planners, International, Nashville, Tennessee.

by

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FOREWORD

Program changes may impact upon educational facilities and educational facilities may at times constrain certain educational program alternatives. The problem is to plan and design educational facilities so they facilitate educational change and offer few, if any, constraints to educational programs.

This paper has been prepared as a background against which a panel of experts might consider planning and designing educational facilities for the future which are somewhat immune to premature obsolescence and to constraining educational program alternatives.

It is important to note that this paper is not based on an exhaustive literature review but rather one that was only extensive enough to enable identification of major landmarks and to obtain a general understanding of the lay of the land.

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A WINDOW ON THE FUTURE

Educational facilities being built today have a life expectancy of 50 years or more and it is unlikely that many of these facilities will be considered for major renovation short of 25 to 35 years. This means that these educational facilities should be planned and designed so that they can be effectively used, without extensive modification, well into the 21st century. The question before us is, How can educational facility planners design and build educational facilities that are somewhat immune to the problems of premature obsolescence as a result of future change in the field of education?

To get at some of ways and means of avoiding premature obsolescence in educational facilities, this paper proposes to identify key factors that may influence education in the future, to identify or develop some scenarios or images of the future, to analyze them and to draw from them some of the implications for educational facilities. These implications, and accompanying questions, may encourage facility planners to propose strategies for planning, designing and building educational facilities that are less vulnerable to premature obsolescence.

Overview of Paper

This paper is organized into six sections: a review of some long term trends that are exerting pressure for educational change, identification and discussion of factors influencing or shaping educational change, a Force Field Analysis of these driving trends and influencing factors, consideration of some other variables constraining facility design, identification of scenarios of the future of education together with some of their implications for educational facilities, and presentation of a set of facility-related questions to be addressed by a panel of experts. More specifically, this paper includes:

- Some long term trends (trends such as the information explosion, communications and computer technology) which are exerting pressure for change in education are scanned in order to develop some understanding of what might occur if these trends were projected into the future. Several scenarios, or images of the future of education, are proposed on the basis of these major observable trends.

- Factors which may influence educational change and the future of education are identified and discussed.

- The "Force Field Analysis" technique is used to derive a better understanding of the forces and factors influencing the future of education and to derive a better understanding of three proposed scenarios of education in the future.

- Other variables which may serve to constrain educational facilities in the future are also identified and their implications noted.

- The scenarios or images of the future are analyzed for potential implications for educational facilities.

- These scenarios, with the accompanying implications for educational facilities, have been presented as background information to a set of questions posed to a panel of experts who will propose strategies for meeting the educational facility requirements posed by the scenarios.

The rationale for this process is simple. If the most probable of the future scenarios suggested by the identified trends is desirable then one can more or less wait and let the scenario unfold. If the most probable future scenario is not desirable, then it may be possible to alter the future through careful planning and intervention. Careful planning may even hasten or ensure the unfolding of the desired scenario. Planning is clearly a key and it is anticipated that discussion of the many issues raised in this paper may lead to planning which contributes to a desirable educational future and to the prolonged usefulness of those educational facilities being planned, designed and built today.

A Look Into The Rearview Mirror

Periods of History

Our history can be divided into four major periods, each separated from its predecessor by a revolution (Toffler, 1980: 13-14). The earliest period, that of the nomadic herdsmen was followed by the agrarian period, the industrial period and now the information and technological period.

The Nomadic Period (Pre - 8000 BC). The nomadic period was characterized by people fully occupied in the activity of gathering food necessary for survival. Because of the migratory nature of wildlife and the seasonal availability of plants, these people were perpetually on the move. As might be expected the base of power in the nomadic clans or tribes was associated with hunting or food-gathering skills. Inasmuch as these people were fully engaged in food-gathering as a matter of survival, there was a little opportunity for anyone to divert precious time away from these essential activities in order to plan a better way of life.

The Agrarian Period (8000 BC - 1700 AD). Eventually some of the nomads learned that they could cultivate land and grow crops and thereby ensure their food supply. To cultivate the land and to grow crops required manpower (brawn). The more land available for cultivation, the more manpower one could support and the more power one had. As a consequence of some land owners being able to produce more food than needed, some were able to enjoy a degree of leisure or free time and this free time gave rise to activities that enabled the agrarian society to begin to transcend itself.

The Industrial Period (1700 AD - 1955 AD). The industrial period was heralded in by the invention of powered machines that could replace human brawn in the workplace. These machines cost money with the result that capital replaced land as the principal base of power. The widespread use of machines gave rise to

assembly line production and an accompanying division of labor. People tended to move to where jobs were available with the result that the extended family, which was the norm in the agrarian period, disappeared and the nuclear family emerged.

The Post-Industrial (Information/Technology) Period (1955 AD -?). Significant advances in transportation, communications and technology gave rise to the development of machines that could operate machines (i.e. computers). Whereas the machines of the industrial period provided a substitute for human brawn, the machines of the post-industrial period serve as a substitute for human brain power. Power now appears to be vested in information and knowledge (Naisbitt, 1982: 7; Science Council of Canada, 1982: 10).

By reviewing these periods in our history, one begins to sense the accelerating rate of change we are now experiencing. This acceleration becomes more apparent in the timeline presented in Figure 1. Another view of the exponential rate of social change can be seen in Figure 2 which describes the explosion in the numbers of first patents for inventions granted by the U. S. Patent and Trademark Office. If patents are a reasonable indicator of increased societal knowledge, then one could conclude that half of our general knowledge base has been developed since 1957.

Some Trends

During my teenage years on a farm in northern Alberta, travel was limited and we had no powered machines to help with the work. (Rural electricity in that area was still in the future and cars and tractors were too expensive.) Now as I sit at my personal word processor in the comfort of my den, I am aware that I have access to dozens of powerful slaves in the form of engines or electrical machines and devices: for example cars, power boats, snow blowers, lawn movers, hedge trimmers, food processors, microwave ovens, hair dryers, calculators, dishwashers, washing machines, dryers, radios, televisions, and on and on. In retrospect it is easy to see that I have stepped from the agrarian era into the post-industrial era. The surprise is that it is only in looking back that I am able to discern some of the trends that have had an effect on me.

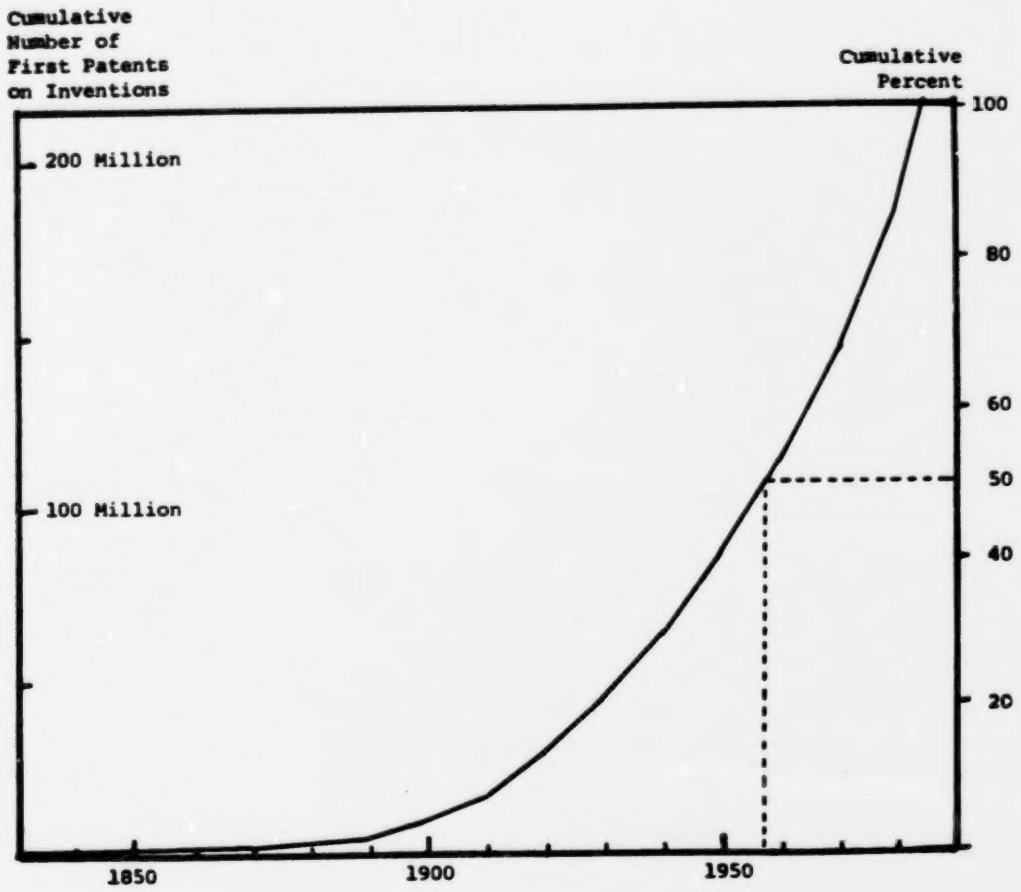
Industrially-Based Trends

Travel. Travel, as one trend, was from the earliest times limited to the speed of walking (or riding if one had an animal of burden) until the invention of the steam locomotive in the early 1800's. The potential speed of travel then increased approximately ten-fold (from 3 to 4 miles per hour to 30 to 40 miles per hour). The internal combustion engine invented in 1885 made possible the automobile and the airplane (the latter attaining speeds approaching 300 miles per hour) and a further increase of speed by a factor of ten. The development of jet engines more than doubled the speed of travel by 1950. In 1957, rockets still further increased the speed of travel to more than 20,000 miles per hour (about ten times faster than a bullet). Until the invention of the steam locomotive, man's speed of travel was limited to the speed of walking. In the space of 100 years following the development of the steam locomotive, man's speed of travel increased from that of walking to that of the early automobile or airplane (about 50 miles per hour). In this century, the speed of travel has sharply escalated from

Figure 1. A Timeline of Events That Have Influenced Education

-10000	---	Development of written language
-8000		Agriculture
-5000	---	
-3000		Formal education established
-300		Development of papyrus
0	---	Birth of Christ
105		Development of paper (China)
500	---	
1000	---	
1440		Printing press
1500	---	
1700	---	
1751		Steam engine
1787		Steamship
1800	---	
1807		Fulton's steamship
1826		Photography
1836		Telegraph
1850	---	
1876		Telephone
1877		Phonograph
1885		Internal combustion engine
1887		Silent movies
1895		Radio
1900	---	
1903		Wright's airplane
1907		Vacuum tube (DeForrest)
1910	---	
1920	---	
1926		Rocket developed (Goddard)
1927		Sound movies
1929		Television invented
1930	---	Facsimile and wire recorder invented
1938		Electrostatic copying
1939		First television broadcast
1940	---	Tape recorder
1941		Turbojet
1944		Jet propelled fighter plane
1946		Vacuum tube computer (ENIAC)
1948		Transistor developed
1950	---	Teletype and solid state computer
1951		Network television
1952		Jet-powered commercial plane
1957		First rocket in space (Sputnik)
1959		Dry copiers and 2-bit integrated circuits developed
1960	---	Communications satellite launched
1961		First astronaut in space
1970	---	
1971		Laser printer concepts and microprocessors developed
1975		Computer on a single board
1976		Integrated circuits (20K bits)
1977		Laser printer (2 pages/second)
1980	---	Electronic mail and 64K integrated circuits developed
1982		256K integrated circuits

Figure 2. Cumulative Total of First Patents For Inventions In The United States From 1836 to 1986 (Patent and Trademark Office, 1986).



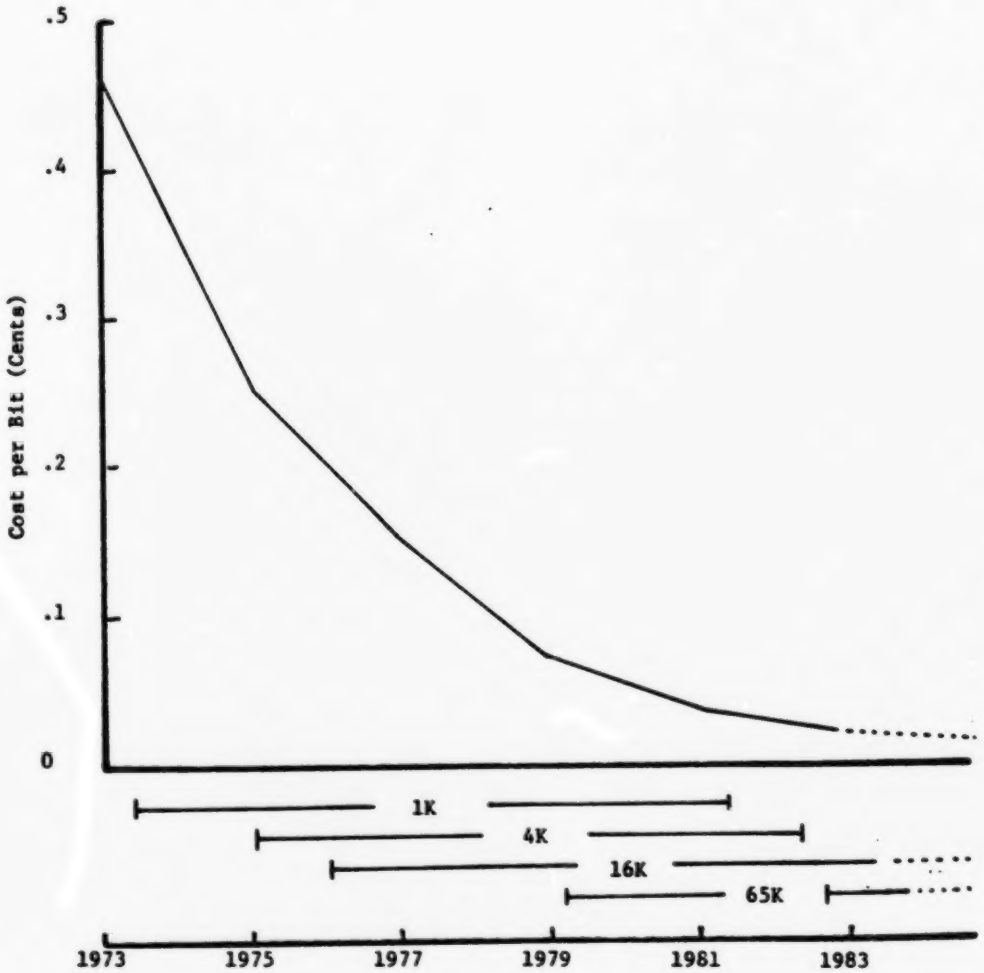
about 50 miles per hour to more than 20,000 miles per hour (the speed of manned rockets today).

Communications. A second important trend is communications. Until the development of the printing press in 1440, almost all communication was by means of the spoken word. The printing press not only enabled widespread use of books, it made easy storage of information possible. The discovery of electricity paved the way for a number of other communication breakthroughs -- the telegraph, the telephone, the radio, and the television. Communications technology coupled with the speed of rockets made communications satellites possible. With each new invention came an increase in the number of people that could be communicated with. Today's communication satellites have coverage patterns that provide hundreds of millions of people with full color, live, television programs. Indeed, the Vietnam war became known as the "living room war" because people watching the evening news via satellite on one side of the world were able to be first hand witnesses to the carnage taking place on the other side of the world. What a far cry from the communications available during my early years. Back then the itinerant pedlar, the mailorder catalogue and the annual almanacs provided our only exposure to the world outside our community.

Computers and Technology. A third trend which must be analyzed for potential contributions to educational change is technology and especially the computer. Though the logic of computers was understood for some time, it wasn't until after the development of the triode tube (1907) and the transistor (1948) that computers became a reality. Transistors might be thought of as one-bit chips. Two transistors were successfully combined into a single two-bit integrated chip in 1959. By 1976, chips were able to hold 20,000 bits (20K chips). Chips with a 64K capability were available in 1980. By 1982, the chip density had increased to 256K. Manufacturers now build computers on chips the size of postage stamps but with power in excess of computers that occupied the space of a whole room only a decade ago. Figure 3 illustrates the rate at which computing power and costs have varied over a short period. The Micro-electronics and Computer Technology Corporation predicts that they will be able to extend today's capability for designing logic chips with 200,000 devices to chips with 10,000,000 devices by 1990 (Fischetti, 1986: 76). The Science Council of Canada (1982: 15) predicts that the cost of computers by 1990 will be 1/400 the price of computers in 1982. Combining this estimate with data included in Figure 3 suggests the 256K of random access memory (RAM) that may have had a cost of $11,520.00 in 1973 and $768.00 in 1982 will cost about $1.92 by 1990. Indeed, computing hardware is so rapidly approaching zero cost that manufacturers may soon be giving computers away so that they can establish the broad base of need necessary to support development of the somewhat more expensive software.

Along with computers, artificial intelligence is another rapidly developing phenomenon that must be watched because it could have a great impact on education. Artificial intelligence means programming a computer to do a variety of complex tasks, e.g. act as an expert system (by building a knowledge base), process oral or written language, or process optical images (Brady, 1986: 26-29). An expert system is, ". . . a computer program that emulates the decision-making ability of a human expert in some field" (Thornburg, 1986: 55). An expert system could serve as an "intelligent coach" in leading a student through a problem-solving strategy, analyzing incorrect responses, and deducing from those responses where the student went wrong. The machine may even be able to identify alternative approaches to help the student get back on track (Brady, 1986: 28).

Figure 3. Projected Cost Per Bit of Computer Memory for Successive Generations of RAM (1K, 4K, 16K, 65K) (Noyce, 1977)



Laser printers are still another interesting phenomenon to track (more or less a micro-trend): interesting because they so clearly portray the rapid rate of change. The principles of electrostatic (drycopying) copying were formulated in 1938. Dry copiers entered the marketplace in 1959. Laser printer copiers were conceptualized in 1971 and by 1977 were operating at speeds of two pages of copy per second. Figure 4 depicts the growth curve of technical papers on solid state lasers -- just one example of the explosion of specialized publications included in Naisbitt's (1982: 16) estimate that 6,000 to 7,000 scientific articles and technical papers are published each day. More importantly, a network of laser printers coupled with computers could quickly deliver hardcopy documents (student lesson packages for instance) over great distances.

This quick look back over our shoulders at some of the long-term trends serves to establish one point -- change is not linear. Change is geometric and the rate of change experienced by each generation is increasing. Society's fund of knowledge is doubling every 5.5. years (Naisbitt, 1982: 16). Because so much of the expanding body of knowledge is relevant to each of us in our daily lives, there is a need for continual learning and without it we can quickly become functionally illiterate. Indeed, Naisbitt's estimate suggests that the half-life of a person's fund of knowledge is now about five years. Perhaps as much as seventy five percent of the total body of societal knowledge that we have accumulated up to now is less than 10 years old. Moreover, approximately 90 percent of all the scientists that ever lived are alive and working today.

Heilbroner (1979: 7) provides an interesting quote from a work entitled The Economic Growth Controversy which puts much of this discussion into perspective:

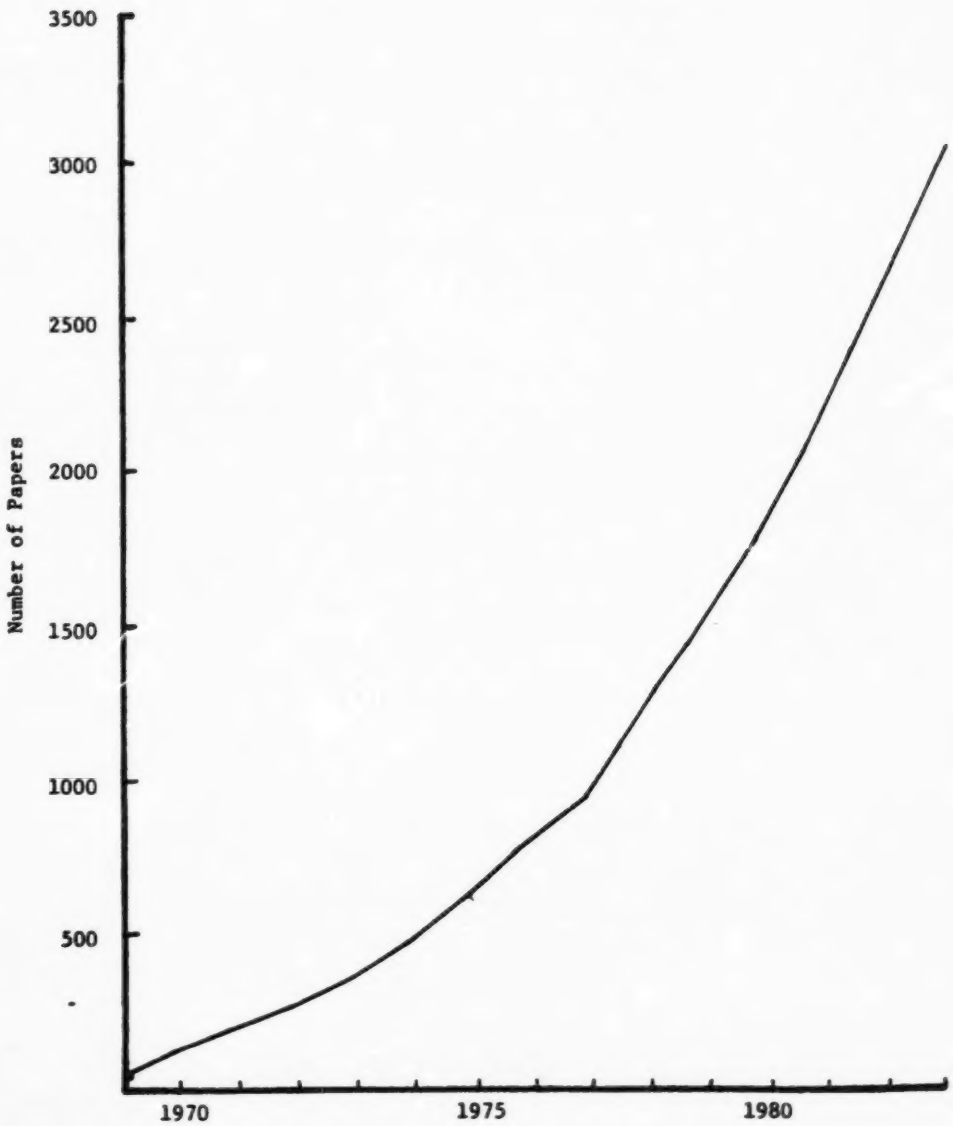
> ". . . Geological time has been made comprehensible to our finite human minds by the statement that 4.5 billion years of the earth's history is equivalent to once around the world in an SST. . . . Man got on eight miles before the end, and industrial man got on six feet before the end. . . ."

Some Other Trends

Besides the industrially-based trends, there are a number of other trends which are significant to education.

Competition. Henchey (1986) contends that competitiveness will play a key role in shaping education in the future. First, graduates of the educational system must be able to take up the reins of the economy and maintain its competitiveness on a world market. These graduates, at least some of them, must be entrepreneurs. Second, public education must be able to compete in serving students. While education has long been regarded as a public enterprise, the last fifty years has seen an increase in the demand for private education. Cooper, et al (1985:20) predict a 32 percent increase in private school enrollment (Catholic and non-Catholic) in the United States for the period 1975-76 to 1989-90 (approximately two percent per year). With the cost of computers dropping and the increased availability of high quality communications technology (and especially phenomena such as artificial intelligence), it is conceivable that the private sector could begin

Figure 4. Total Number of Papers Published on Semiconductor Lasers In The United States and Japan (Bell, 1985)



to cost effectively offer quality educational programs thereby further increasing the competition in the educational arena. Schools in the future may survive solely on the basis of high quality educational outcomes and good marketing.

Demands for Accountability. The public is concerned about the declines in educational productivity (e.g. falling SAT scores) and beginning to clamor for greater educational accountability (Henchey, 1986).

Transformation of Knowledge. Henchey (1986: 5) observes that:

> There is a revolution taking place in knowledge and its role in society. This includes: an information explosion in almost every academic and professional field, expanding bodies of data (including personal information), technique and theory; improvement in our methods of acquiring, storing and controlling information; increasing speed of dissemination to the public, changing the context of 'knowledge work' and 'knowledge industries'; and, at a deeper level, the transformation of paradigms, models and assumptions ('new' physics, critiques of rationality and technology, studies in artificial intelligence). What land was to a pre-industrial society and money was to an industrial society, knowledge is to a post-industrial society.

Economic Instability. The economic structures and concepts that were developed to serve an industrial society (land, labor and capital are the only factors of production, for example) may be severely shaken in the societal restructuring that is imminent or already occurring. Naisbitt (1982) makes a strong case that information (the ability to get it, process it and use it) is a fourth factor of production -- and perhaps among the most important. Moreover, because the economic model currently in vogue is not as effective as it could be in working out the relationships between inflation and unemployment, and because a number of financial institutions, and even nations, have become very shaky, there is a nervousness and concern about economic and financial matters. The present (March, 1986) drop in world oil prices illustrates how much sensitivity and instability there is in the economic system. This may have the effect of placing even greater emphasis on such concepts as accountability.

Integration. Four types of integration are considered: the first three are integration within the curriculum and integration both within people and among people. There are some signs that the traditional content and subject-centred curriculum may have to give way to an integrated and integrative curriculum (Nelson, 1985: 8). He contends that impacts and relationships of ideas and actions will be more important than the tunnel-vision approaches fostered by subject-area specializations. Narrow specialization often leads to nothing but sterile and inert ideas.

The fourth type of integration is the integration of planning -- locally, nationally and internationally.

> All contemporary experience thus points to the reality of an emerging world system in the widest sense which demands that all actions taken on major issues anywhere in the world be taken in a global context and with full consideration of the

> multidisciplinary aspects. Moreover, due to the extended dynamics of the world system and the magnitude of the current and future change, such actions have to be anticipated so that adequate remedies can become operational before the crises evolve to their full scope and force (Mesarovic & Pestel, 1974: 31).

Cultural Pluralism. There is a universal need to bring people from a variety of backgrounds together. Whether it is the American "melting pot", the Canadian "mosaic", or any other way of integrating people into an open and pluralistic society, there must be a learned awareness of, and respect for, each other in order to allow each to make their maximum contribution to the betterment of society at the local, regional, national and international level.

A Look at Education From the Inside

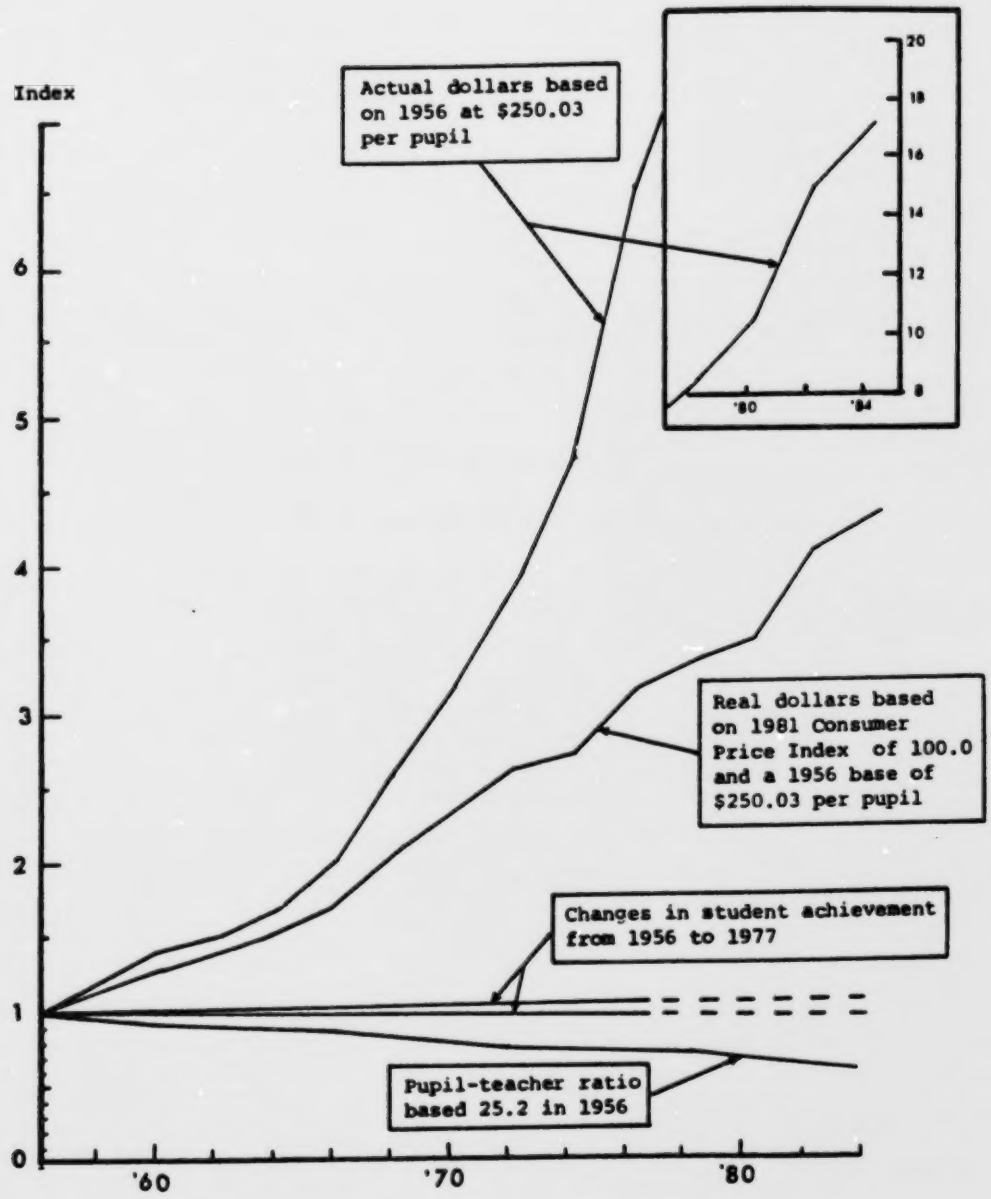
Pressures for Change

Quite aside from the long term trends in communications and computer technology, education itself is being impacted by several forces which are internally producing pressure for changes -- factors such as declining educational productivity, rising educational costs, competition (especially from private schools) and cries for accountability. At the same time system inertia and the vested interests of educators and administrators mitigate against significant change.

Declines in Educational Output. Figure 5 describes an Alberta case which is particularly significant. A study conducted in 1977 (Clarke, et al,) compared Grade 3 students in an urban setting with their counterparts from 1956. The same test instruments and norms were used. The results of the study confirmed that the students in 1977 did as well as the students in 1956, except in arithmetic (i.e. the scores of both groups on five tests were within an average of three percentage points of each other). These results were used as the basis for the argument that educational productivity hadn't declined. An examination of Figure 5 will reveal, however, that educational costs (in real dollars) had increased significantly while the pupil-teacher ratio had declined significantly during the 1956-1977 period. It would have been quite reasonable to expect students in 1977 to outperform their 1956 counterparts simply because of the increased educational resources expended in 1977. On the other hand, it may be that there were other desirable educational outcomes which were not measured by the achievement measures used.

On a broader front, declining Scholastic Aptitude Test (SAT) scores have been acknowledged for some time. Beaton, Hilton and Schrader (1977) documented the trends from 1960 to 1972. Cetron (1984: 44) and Christiansen (1985: 33) observe that the decline continues. Harold Howe II (1986: 18-21), in an analysis of factors contributing to the declining SAT scores, concluded that 50 percent of the decline was attributable to a change in the composition of the test-taking group over the years. A further 25 percent of the decline was found to be related to broad social issues: the effects of television, the effects of life in single-parent families, the effects of being latch-key children, and the effects of national traumas -- the threat of nuclear war, the Vietnam war, civil rights unrest, and so forth. The final 25 percent was found to be related to school-based factors: simplification of

Figure 5. Educational Productivity (Student Achievement) and Related Trends in Alberta (1956 - 1984).



textbooks, declining integrity and continuity in courses of study, failure to establish adequate standards of learning, and insufficient emphasis on writing skills.

While educators may be relieved to learn that they are not totally responsible for these declines, the public isn't so well informed. The public still perceives educational outcomes as being in decline and expects improvements.

Sadly, attempts to reverse the trend of declining SAT scores are complicated by the fact that the average SAT score for those entering the teaching profession (SAT = 812) is below both the average for many other professions (e.g., engineering SAT = 987) and the average for all students who took the test (SAT = 893) (Cetron 1985: 113). A report prepared in July 1984 (Darling-Hammond, 1984: 2) makes the same point on the basis of analysis of SAT scores for the period from 1973 to the early 1980s. Education seems to lack the prestige (as manifested by good salaries and professionalism) necessary to attract the excellent candidates that are required if education is to lift itself out of its problems by its bootstraps.

Increasing Costs Of Education. Figure 5 which is based on recent data collected in Alberta indicates how educational costs have increased over time, both in actual dollars and in real dollars as measured against the 1956 dollar. The trend is similar in other locations (National Center for Education Statistics, 1985: 21).

One of the more significant aspects of the high cost is the fact that a great deal of hardware (audiovisual devices, computers etc.), software and peopleware (inservicing) has been layered over an already costly, labor-intensive, educational delivery system. The private sector practice of trying to substitute one factor of production (e.g. capital, such as robotics) for another factor (e.g. labor) in order to increase productivity or to reduce costs, or both, is not frequently encountered in public education.

Goals Of Education. There are demands for integration in education. One suggestion calls for a multi-disciplinary approach partly centered on problem-solving and the development of the intellect for constructive thinking. It must also be centered on the development of the empathetic sensitivity which will prevent one from dismissing matters of human value. It is a matter of balancing these two because if we pay attention to only one, the other will necessarily remain underdeveloped. Both are required for the development of "intelligence", properly speaking. Both involve ways of knowing into which children should be initiated. Both should be part of the deliberately planned learning which is too important to leave to chance in the environment of the general culture. Deliberately planned learning -- with a curriculum and a certain physical environment -- is the very reason for which we have schools. They provide the environments in which we make it easier for children to develop their own minds and find their own insights into the truth of things. Part of what educators should be doing is to encourage students to work out for themselves the ways of testing different kinds of truths in various aspects of their lives, in supportive relationships with their peers and teachers, and with knowledge support systems in a physical environment which encourages discovery of all kinds. This shifting in the goals of education is resulting from demands for: holistic and integrative approaches to both problem-solving and dealing with people; lifelong learning; learning to learn; individualization so that each person can develop to his or her own potential; and development of an inquisitive and innovative spirit in students.

Another way of looking at the goals of education is to consider them on the basis of an individual choice/social demand continuum. Traditionally, individual choice has played a large part in determining curriculum content. There are now some signs that the curriculum content might become more closely geared to social demands. As one example, the Government of Alberta (1985: 67) distributed a position paper on economic development that advocates economic education and entrepreneurship as components of the curriculum.

Barriers to Change

While there are significant pressures for change in education, there are also a number of barriers to change.

Educational System Inertia. With the level of teacher experience (i.e. years out of college) at about ten to twelve years (Education Almanac, 1984: 37) and with the half-life of education at about five years, it is highly probable that much current educational theory is not able to find its way into practice. Tobin and Sharon (1984: 22) observed that in education, "New technologies are, like older technologies, being incorporated primarily as teaching aids in a largely unchanged educational system". Ferguson (1980: 280) reached the same conclusion: education is not very dynamic. Interestingly, these observers echo the findings of researchers working a decade earlier (Goodlad and Klein, 1970: 72 & Shane, 1973: 329-330, for example).

The inertia may be the result of a variety of factors: inadequate incentives and awards for improvement; inappropriate organizational climates; inept change processes; and inadequate teacher preparation. The inertia may also be a reflection of the fact that education (at least at the elementary and junior high levels) is very much confined to its present form by the custodial care and socialization roles also ascribed to schools. For the form of educational delivery to change very much would mean finding alternate ways of providing custodial care for children while parents work.

Vested Interests Of Teachers. Over the years teachers in most areas have formed themselves into unions and included in many of their contracts are definitions of working conditions including specification of the pupil/teacher ratio. The unions may be expected to cling to these hard-won working conditions even though the effect may be to slow particular types of educational change.

High Costs Of Educational Change. It must also be recognized that the high cost of technology, and the need for substantial reorganization of the curriculum to make it compatible with technological approaches are other factors which inhibit widespread use of technology (Miller, 1981: 18).

Possibilities: Three Scenarios (Images of the Future)

The trends analyzed to this point suggest that several forces are at work in our society and they are beginning to produce a pressure for change in education at all levels. Figure 6 illustrates one way in which these trends and pressures may be viewed. While it is possible at this point to identify and describe the difference pressures at work, it is impossible to predict which pressure will be most instrumental in bursting through existing barriers or when the bursting will occur. However, as with all expanding forces (and especially those which grow at a geometric rate) the point arrives when no opposing force or forces can contain them. Right now it appears that there are three major forces opposing significant educational change -- the inertia of the educational system, the vested interest teachers have in preserving the current labor-intensive mode of educational delivery, and the high costs associated with any substantive change in education.

A clustering of some of the forces working to produce educational change gives a hint of the type of educational system that might emerge if any one of the following clusters of forces remained intact and relatively immune to other competing forces while at the same time exerting its full force on reshaping education.

Cluster 1. The potentials available from industrial models and the use of technology (communications, computers and artificial intelligence) to extend human capabilities in areas of thinking, problem-solving and managing are staggering. Education could be effected as profoundly by these phenomena as is the case in the marketplace. A second element is competition, both the need for maintaining a competitive economy and also competition within the educational arena -- especially by private schools and private sector enterprises.

Cluster 2. The demands for accountability and application of cost-benefit equations to education are based on the belief that education should be more productive. This belief is being translated into pressure for educational change and aligned with concerns about the economic instability or turbulence evident in most sectors of the economy.

Cluster 3. The need for accommodating cultural pluralism and for multidimensional integration are raising the prospect that educational content and delivery must change in order to meet the new demands -- the old educational content and delivery patterns may not be adequately effective. This need for change is further advanced by the changing role of knowledge in society which some (e.g. Naisbitt, 1982) regard as roughly equivalent to a factor of production.

Henchey (1986) has examined these forces, worked through their impacts on education, and developed three "images of the future" which he has labelled the "superindustrial scenario", the "authoritarian scenario" and the "ecological scenario". A fourth image can be developed if one regards the cracks in the dam shown in Figure 6 and observes the rising pressures of change. The name of the fourth image could be "crisis" or "collapse". For this scenario the educational facilities that we design today should be analogous to a raft: it can float and it can move with the flow.

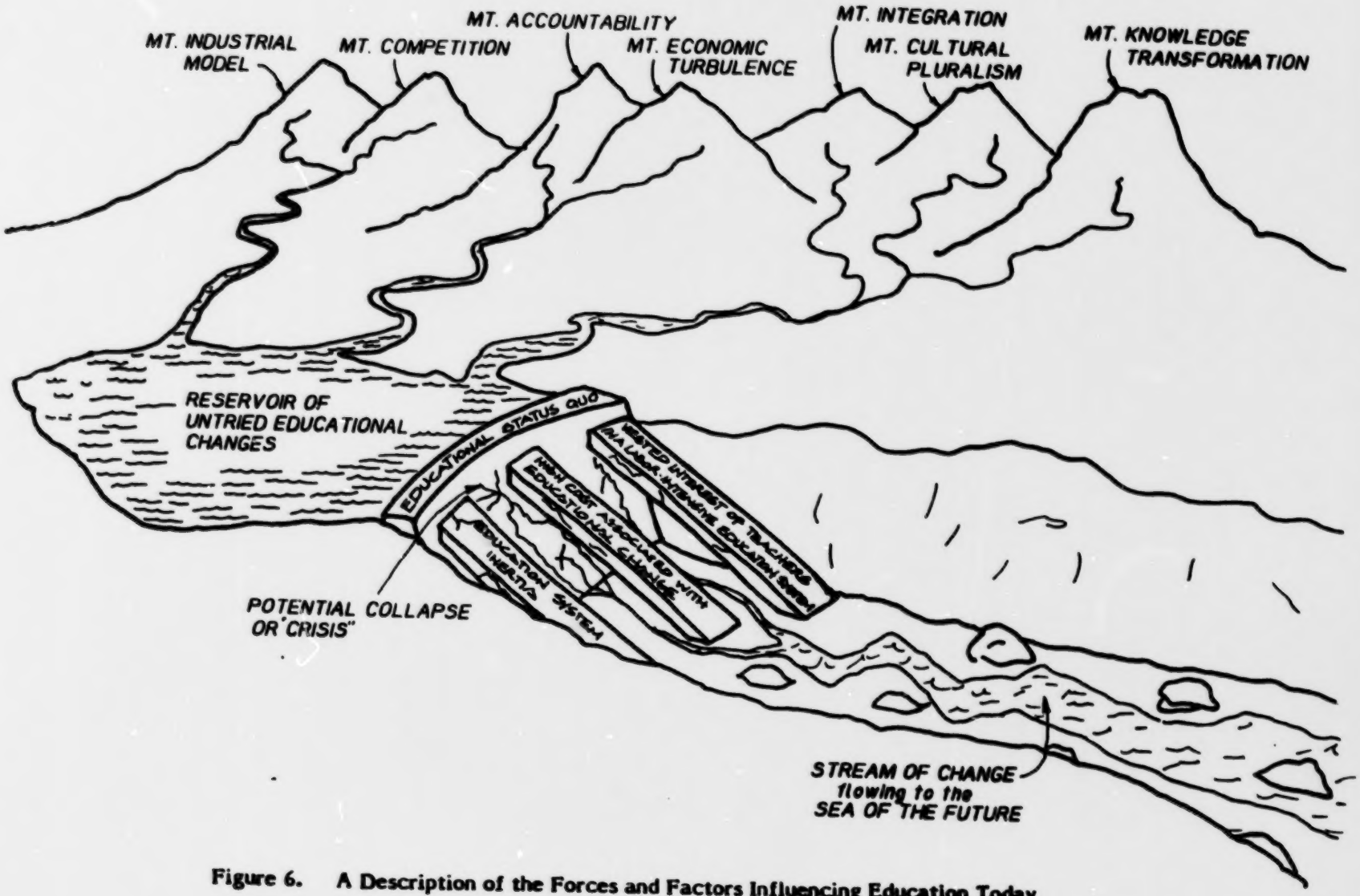


Figure 6. **A Description of the Forces and Factors Influencing Education Today**

Before one can address the question of the impacts these scenarios contain for education and educational facilities, it is essential to examine a number of other forces and factors with a potential for influencing educational change. As this is undertaken it must be kept in mind that the "crisis" scenario is a do-nothing scenario -- it will occur through inaction. The Communications Era Task Force (1983:4) puts things into perspective.

> Each crisis we face is both a problem and a hope, a challenge and an opportunity. As we leave today's crossroads, we can rush down the path of breakdown or turn the corner toward breakthrough.

Other Factors Influencing Education Change

Our nomadic ancestors had hundreds, and perhaps thousands, of years to adjust to the changes occuring in their society. The agrarians also had time to adjust to most of the changes occuring around them. In the industrial period the changes began to occur more rapidly and people had to learn to adjust to a number of major changes in a lifetime. The rate of change is now at the point where major shifts in society have to be accommodated in just a few years (sometimes even months).

Clearly, the direction society follows is shaped by a great many simultaneously occuring phenomena. The same is also true of education and, indeed, there are a number of factors (with the potential for positive or negative influence on educational change) now visible that appear to be capable of influencing or shaping our future.

Curriculum. With the current explosion of knowledge identified and described by Naisbitt (1982: 16) the whole concept of subject-oriented programs in schools is called into question. A more practical approach to education may be to describe a core curriculum consisting of basic reading, writing and mathematics (Cetron, 1983: 3) and directed at helping students learn how to acquire, evaluate and use information which will help them meet their individual objectives. (Evaluation of copious amounts of information will be imperative: students should develop a healthy skepticism.) The Communications Era Task Force (1984: 11) itemizes a number of values which will be even more essential tomorrow than today: honesty; responsibility; humility and love; recognition of interdependence and interconnectedness; understanding that all actions have mixed consequences; cooperation; appreciation of diversity; and authority based on competence, knowledge and wisdom rather than force. With these skills and values students may pursue learning for a lifetime, augmenting their knowledge, skills and abilities as needed.

These skills and values may be most readily acquired in an educational program of the type illustrated below (Miller, 1981: 20).

We must create an educational program that carries students:

From . . .	To . . .
o Mass teaching	o Personalized teaching
o Single learnings	o Multiple learnings
o Passive answer absorbing	o Active answer seeking
o Rigid daily programs	o Flexible schedules
o Training in formal skills and knowledge	o Building desirable attitudes and appreciations that stimulate a questioning for knowledge
o Teacher initiative and direction	o Child initiative and group planning
o Isolated content	o Interrelated content
o Memorized answers	o Problem awareness
o Emphasis on textbooks	o Use of media in addition to texts
o Passive mastery of information	o Active stimulation of intellect

Societal Values. Evidence is beginning to accumulate which indicates that the traditional work ethic (hard work and delayed gratification) may be shifting toward instant gratification and a regard for work as but one of a range of options (Morrison, 1979: 158-162).

Life-long Learning. If the half-life of our education is now in the range of five years, it is plainly evident that there will be a great need for re-educating a significant part of the population (perhaps several times over). For many people whose formal education ended at the elementary or secondary level, the re-education may begin at the same level. Similarly, universities and other post-secondary institutions may be expected to retrain their graduates.

Leisure time is also increasing. While the nomads had none and the agrarians relatively little, industrial man only works 35 to 60 hours per week and thus has some leisure time. Predictions are that people in the post-industrial period will have even more leisure time. Educational institutions (secondary and post-secondary) may be expected to provide educational programs to occupy part of this leisure time.

Individualization. In many ways the industrial period was characterized by standardization. Manufacturing processes occurred on the assembly line. Parts were standardized and put together by people following pre-defined steps. As workers left the assembly line others replaced them and the assembly process continued uninterrupted. Now computers and robots are performing many of the assembly line routines. Skilled people are engaged in more individualistic activities. As a consequence the educational needs are changing. By the same token the school as a factory producing standardized products for an assembly line world may no longer be viable. Many contend that the schools must somehow meet the individual needs of its clients. Toffler (1970: 266-267) is one who believes that technology holds the potential for widespread individualization of education in the same way that it allows me to have an assembly-line car that is different from any

other car produced on the assembly line. (The combinations that can be created from multiple choices of color, body design, engines, transmissions, and options and add-ons are staggering in number. It must be noted that it is standardized processes that give rise to individualized outputs. Although little has been accomplished by way of bringing computer technology to bear on the problems of individualization, as suggested by Toffler over a decade ago, Figure 7 suggests some of the components that might be considered in an individualized and lifelong educational system.

Inability of Use New Technologies. Imbedded in the field of high technology is artificial intelligence which if perfected may have tremendous impacts on education and educational technology. A major stumbling block, of course, is the unpreparedness of educators to use such sophisticated tools as artificial intelligence, interactive computer/laser disc configurations or interactive satellite communications, for example. The impact on public education, of this inability to effectively use technology, may take the form of private sector intrusion into the traditional domain of public education.

High Touch. Naisbitt (1982: 35) argues that to the extent that technology is adopted to provide for the individualization in education, there must also be a counterbalancing high-touch mode. Renfro (1982: 43-48) supports this view by reporting that human need for social contacts are frequently unmet in the confines of one's home office.

Shrinking Education Support Base. An analysis of population statistics points to an aging population and a lowered birthrate. According to Cetron (1985: 44) the over-60 age group will grow from 13 percent of the total population in 1960 to 17 percent in the year 2000. Paralleling this trend is the fact that the U. S. birthrate has dropped from 23.7 births per thousand of population in 1960 to 15.5 in 1983. Canadian statistics are more extreme, falling from a birthrate to 26.8/1000 in 1960 to 15.0/1000 in 1983. This means that in the future the percentage of the population with children in school will be smaller than the percentage without children in school. The National School Board Association (Page A23) notes that the percentage of American households without children increased from 54 percent in 1970 to 64 percent in 1984. It is easy to imagine that for those without children in school, education may become a low priority. If that proves to be the case, education may have to compete more vigorously for tax support in the future than has been the case in the past. Moreover, "grey power" (organized senior citizens) is on the increase.

"Grey power" increases as the overall population ages. The Canadian government unexpectedly ran into the full power of this force when it tried to de-index or reduce the overall old age security benefits. In the end the Government had to withdraw its plans. Not only are the seniors growing in numbers, they have a number of attributes or characteristics working in their favor when it comes to exercising political clout. Consider, for example, they have an abundance of free time for cooperative activities like lobbying, they have the intellectual and financial resources necessary, they are articulate, and they are still held by the public in the same high regard as the flag, motherhood and apple pie.

Highly Skilled Workforce. The post-industrial, high information, high technology society will probably be characterized by a highly skilled workforce. There may be a concurrent shrinking of the blue collar and white collar sectors, largely

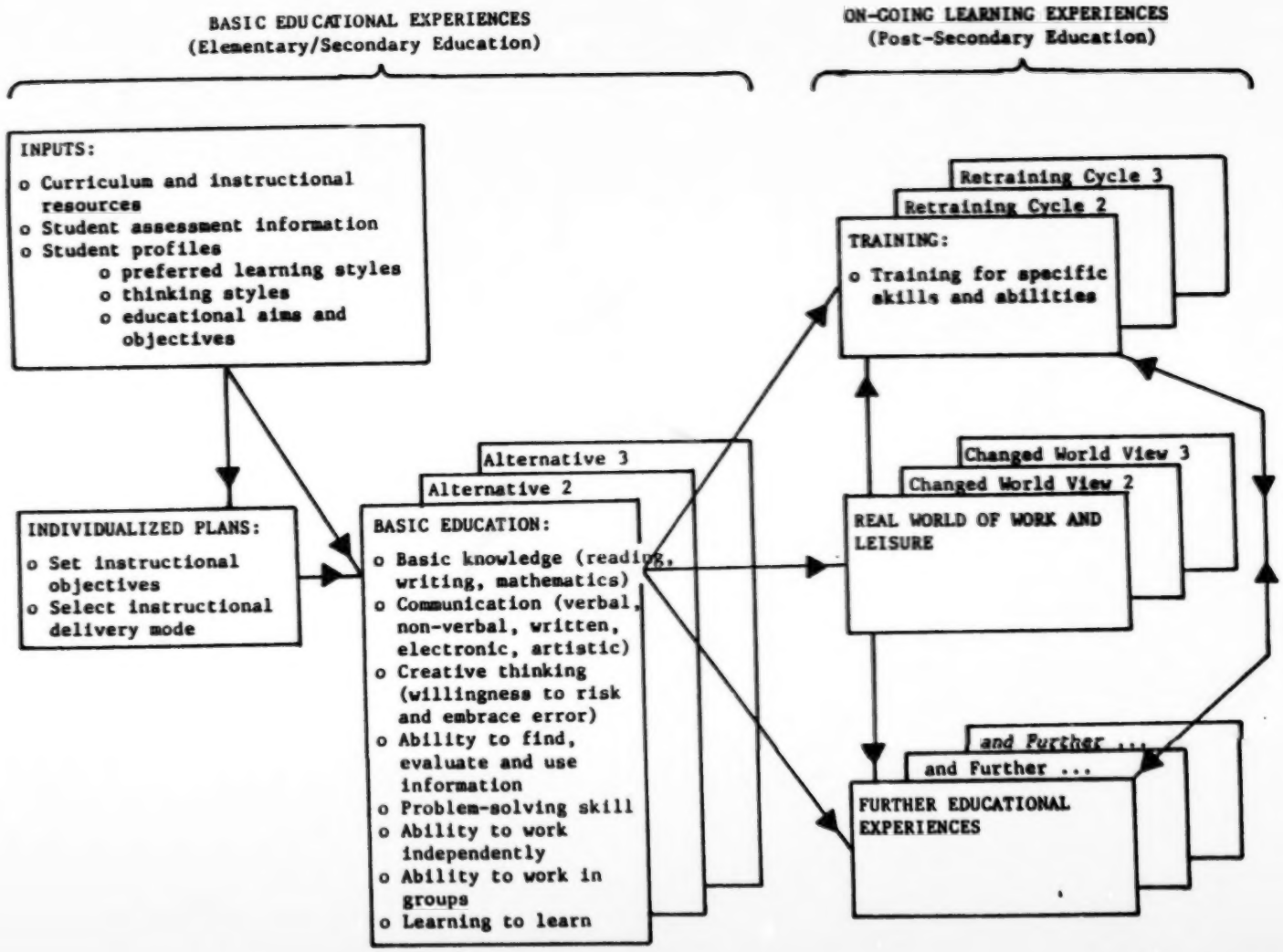


Figure 7: Components of an Individualized Life-long Learning System: A Framework for Planning an Educational Pilgrimage

through the use of robotics (Albus, 1983: 22-27; Coates, 1983: 28-32; Best, 1984: 61-66). Remaining will be the lower quality jobs and the jobs included in the service sector. This poses a problem. Not everyone will have the abilities to pursue the skilled jobs and not everyone will want the jobs open to the unskilled. What will these jobless people do? Albus (1984: 38-40) suggests that they may earn their livelihood by owning and leasing robots.

Structural Unemployment. Naisbitt (1982: 68-70) and Best (1984: 61-66) make the point that we are in the throws of a societal restructuring -- a collapsing of the industrial structures and an emergence of the post-industrial structures. These observers believe that the emerging society will not need, or be able to accommodate, as many blue and white collared workers as was the case in the industrial society. They further contend that the relatively high unemployment we see today may be more an already-occurring artifact of societal restructuring than it is an artifact of the state of the economy. To the extent that their perceptions are correct, educational institutions may have to help people find meaning for their lives from something other than work -- the most significant source of meaning and self-worth for industrial man. Morever, there will have to be mechanisms other than the labor market for distributing wealth.

Extended Out-of School Care. As the number of single parents increases along with the number of women in the workforce, there will be an increased need for day care services and for out-of-school care services for children of school age. Because people will have more free time in the future, and this increased free time will likely raise the demand for additional services, many of the new jobs in the future may be in the service sector and may extend well beyond the traditionally accepted range of working hours (i.e., nine to five, five days a week) (Cetron, 1984: 429; Rich, 1984: 43). As a result, the demand for child care services may extend to 24 hours a day, seven days a week. Hotels for children (maybe even subsidized) may be a possibility.

Partnerships. Students graduating from high school today have spent less than nine percent of their lives in school. More than ninety percent of their time has been in the presence of influences other than the school. Schools clearly have a number of partners when it comes to developing a child to his or her full potential. Because schools can't be all things to all people, these partnerships are going to be more important in the future than they been up to now.

Roles of Schools. When formal schools first emerged, and from then well into the 20th century, they provided places for students to learn the skills and abilities required in order for them to fit into the world of work as good responsible citizens. During this period the principle role of schools was to provide a place for children to obtain their necessary education and to become socialized.

With World War II came the entry of significant numbers of women into the workplace. For the families where both parents were working, school began to take on a new role -- a custodial role. Schools provided a safe place for children to be while their parents worked.

This multiple role of schools is becoming even more apparent today. Play schools, day care centres, kindergartens, and out-of-school care programs all serve to provide opportunities for parents to be free from their children for periods of time.

While it is unclear how future changes will alter these roles of schools, it is important to keep in mind that schools are more than centres of learning.

An Analysis of Forces Influencing Educational Images of the Future

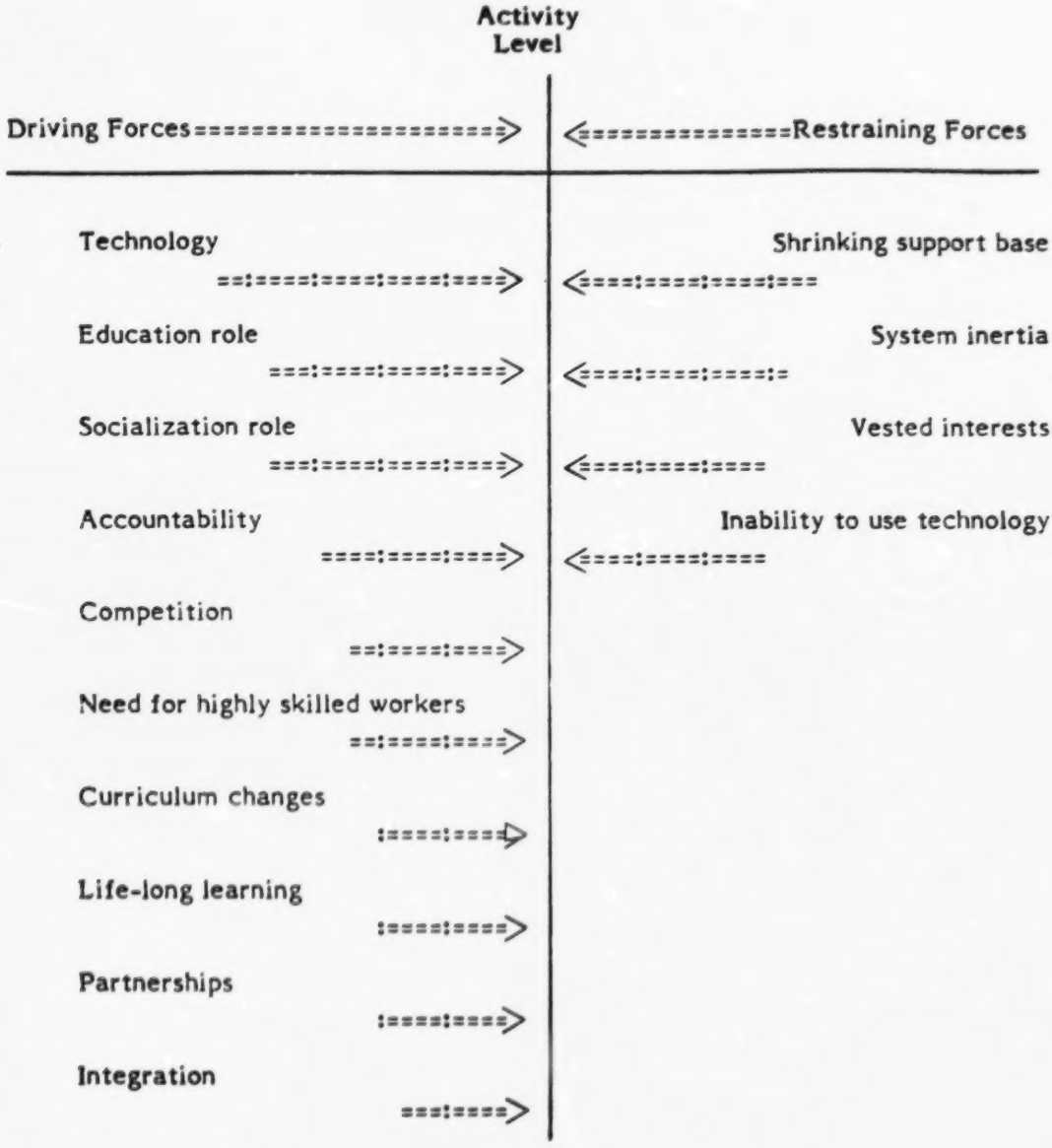
The factors already identified as having a potential for influencing education in the future can be submitted to Lewin's Force Field Analysis (Owens, 1981: 259-264) as shown in Figure 8. Through this analysis it is possible to look at education in equilibrium and to gain a better understanding of the nature and direction of the influences (the restraining and driving forces) as well as to better see the relationships among the factors.

The length and direction of the arrows contained in Figures 8, 9, 10 and 11 describe the relative importance of the factor or force and are based on the opinions of a review panel selected to consider the significance of identified factors and forces on possible educational futures.

Allain (1979: 21) describes three types of futures: the possible, the probable and the preferable. Henchey (1986) contends that there are at least three ways of developing an understanding of the future: through projected images, proposed images and planned images. All three types of images help us to see something down the road that we may want to achieve and they help us understand the types of planning that might occur or the types of interventions that might be made in order to attain a desired goal. Without a positive and flourishing image of the future, cultures or societies decay (Polak, 1973: 19). A prophet said the same thing a long time ago, "Without a vision, the people perish" (Proverbs 29: 18).

Out of the trends and forces placing pressure on education, Henchey (1986) has advanced three projected and possible scenarios, the superindustrial scenario, the authoritation (economic) scenario and the ecological scenario, each based on a different set of factors. These three scenarios are projected and possible images of the future of education. Certainly, it could never be argued that they are planned or preferred. Neither should anyone argue that projected images of the possible future of education are highly reliable. The trends that have brought us to the point where we are today may shift significantly in the future. Moreover, there may be some unexpected events in the future that markedly and unpredictably shift trends. Some examples of unanticipated past events that have altered the course of history include: the bombing of Pearl Harbor, the energy crisis of the early 70's, major discoveries like the transistor or oil in the Arctic, the assassination of John F. Kennedy, and the explosion of the spaceship Challenger. Finally, some social changes come about through something akin to crystallization -- today things are as they always were, tomorrow a whole new set of structures will have fallen into place. The process is nurtured by the networking of people until something like a "critical mass" occurs.

Figure 8. Force Field Analysis of Factors Associated With Education Today



The following factors were perceived by an ad hoc review team to be neutral with respect to education today: individualization, high touch, custodial role, shifting goals, out-of-school care, educational decline, increasing educational costs, economic turbulence, high costs of change, structural unemployment, knowledge transformation, cultural pluralism and societal values.

A fourth scenario -- the "crisis" or "collapse" scenario -- is only mentioned in passing and is not analyzed in the same way as the other three. However, if the driving forces of technology, the extent of change required in the content and delivery of education, declining educational outputs, and spiralling educational costs are set against the restraining forces of educational system (institution) inertia, a human resource complement that is lacking an understanding of how to use technology to advantage, and the relatively high cost of educational change, the question that comes to mind is this, Can the "crisis" or "collapse" scenario be held in abeyance until one of the more preferable scenarios unfolds?

Believing that the collapse of public education may be avoided, the three possible scenarios (and certainly preferable to the "collapse" or "crisis" scenario) are examined further and the factors believed to be capable of influencing the nature of educational change are analyzed within the framework of the Force Field Analysis.

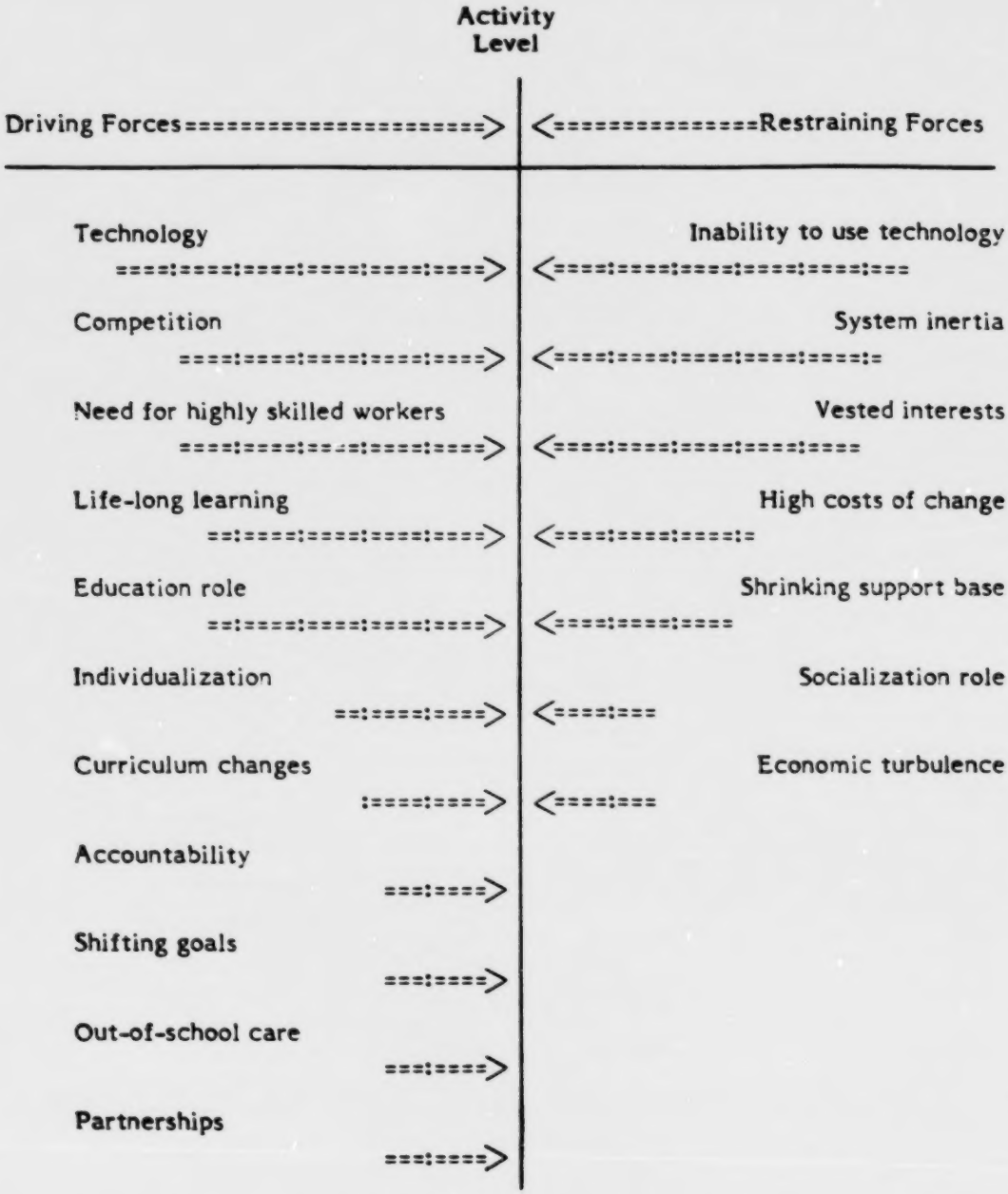
The Superindustrial Scenario

If one were to weigh the strongest and weakest sets of factors in the Force Field Analysis as shown in Figure 9 the result would point to this scenario as being possible.

Consider first the factors that are already present and at work in the educational area: knowledge is equated with power; communications technology has progressed to the point that interactive television is accessible by the vast majority of the population; schools are seen as fitting into a large information network (local area networks, wide area networks, education networks) (Quick, Flashman & Gibeau, 1984: 20-33); computers (though in a limited way) are used for assisting learning, managing learning, managing resources, and administration; learning systems are becoming franchised; costs of education in the traditional mode are outstripping outcomes; and we are coming to accept major technological interventions into society (Communications Era Task Force, 1984: 6). (Consider, for example, test tube babies, genetic engineering, genetic counselling, abortions on demand for any reason -- in effect "designer children".) A trend which is now emerging that would further support the superindustrialization scenario is the renewed concept of cottage industries, but, this time they are information-related industries such as word processing, software development, and so forth. Daily drives to and from an office are being replaced by telephone calls or computer-to-computer hook-ups (Eder, 1983: 30-34).

Opposing pressures or forces identified in Figure 9 are principally those of institutionalized education. Teachers may be expected to resist the development of any sort of technologically-based educational system that undermines their job security. A second inhibiting factor is the need for individuals to be in contact with each other -- technological systems are perceived to be aimed at the individual and lacking in the "high touch" domain. Thirdly, the front-end development costs contained in the superindustrialization scenario are high.

Figure 9. Force Field Analysis of Factors Associated With The Superindustrial Scenario



The following factors were perceived by an ad hoc review team to be neutral with respect to the Superindustrial Scenario: educational decline, cultural pluralism, structural unemployment, increasing educational costs, societal values, integration, high touch, and the custodial role.

The Authoritarian (Economic) Scenario

Figure 10 examines a different cluster of forces and factors in the Force Field Analysis. The authoritarian scenario is founded on the supposition that the depicted driving forces will become the dominant forces as the future unfolds.

As with the previous scenario, there are some signs around us that lends credibility to this scenario. The economy is undergoing a shaking and the effects are felt world-wide, banks are unstable, unemployment is high and not responding to the normal market and economic stimuli, resources are becoming scarcer, debates are raging on the issues of declining educational standards, educational costs are under scrutiny, accountability is becoming a buzz word, data banks are growing and they include more and more personal information -- information that could ultimately be used to judge the societal worth of an individual. These factors clearly suggest an environment conducive to authoritarian control -- someone taking charge and setting things back on course. Education also has some new expectations placed on it -- expectations that it will produce entrepreneurs, risk-takers, people who can take control.

Countervailing forces might be concerns about the invasion of privacy of information and concerns that educational outcomes cannot be easily dealt with in a cost-benefit model.

The Ecological Scenario

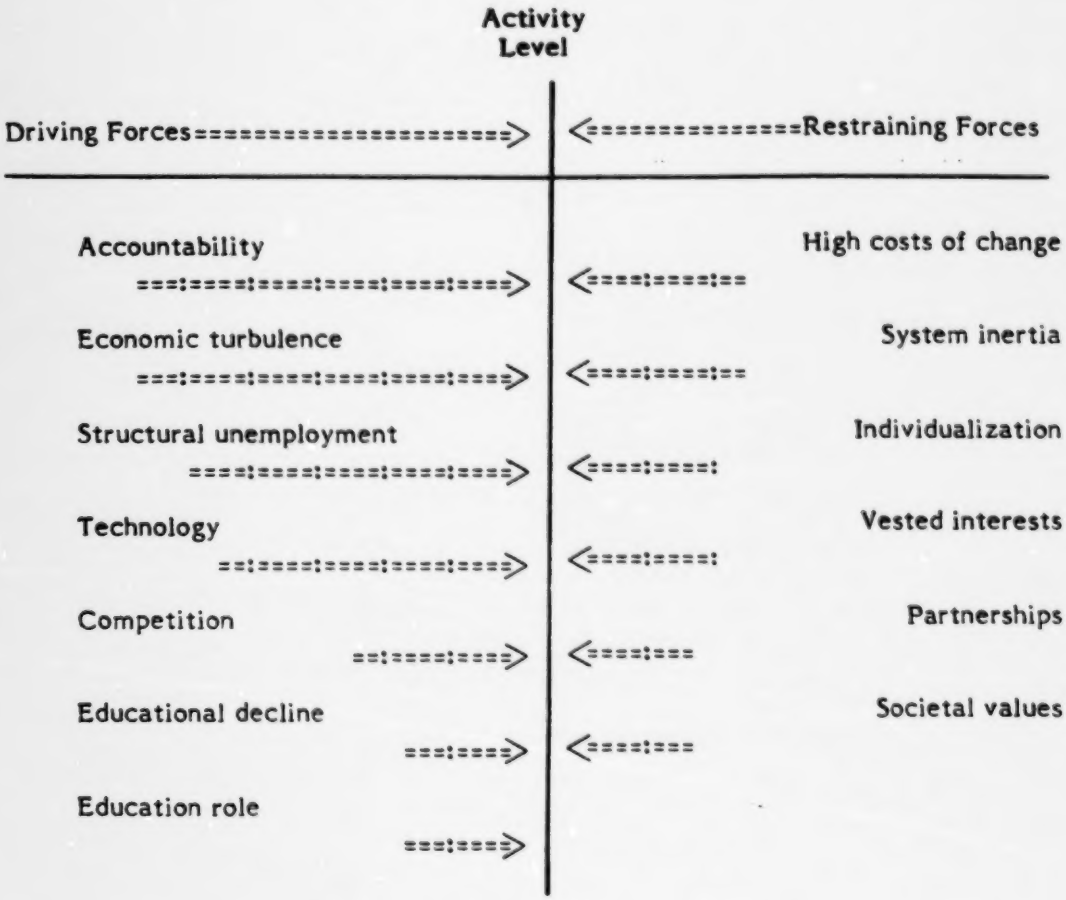
A still different set of factors has been identified (Figure 11) which could become dominant factors in the future thus giving rise to what might be called the ecological scenario. In this scenario people are important. Attention will be paid to individual differences (cultural, ethnic, language, religion, geography, learning styles, and personal aspirations). Recognizing that there may not be enough work to go around, the faltering work ethic may be replaced with another base for the derivation of meaning of life and self-concept. The significant role knowledge plays in society is also producing pressure for change.

Working against the pressure to advance the ecological scenario of the future are such factors as: those concerned about educational efficiency and the traditional set of values pertaining to work and delayed gratification. In other words, the ecological scenario may not portray education as being terribly cost-effective and efficient.

Other Factors Constraining Educational Facilities and Facilities Design

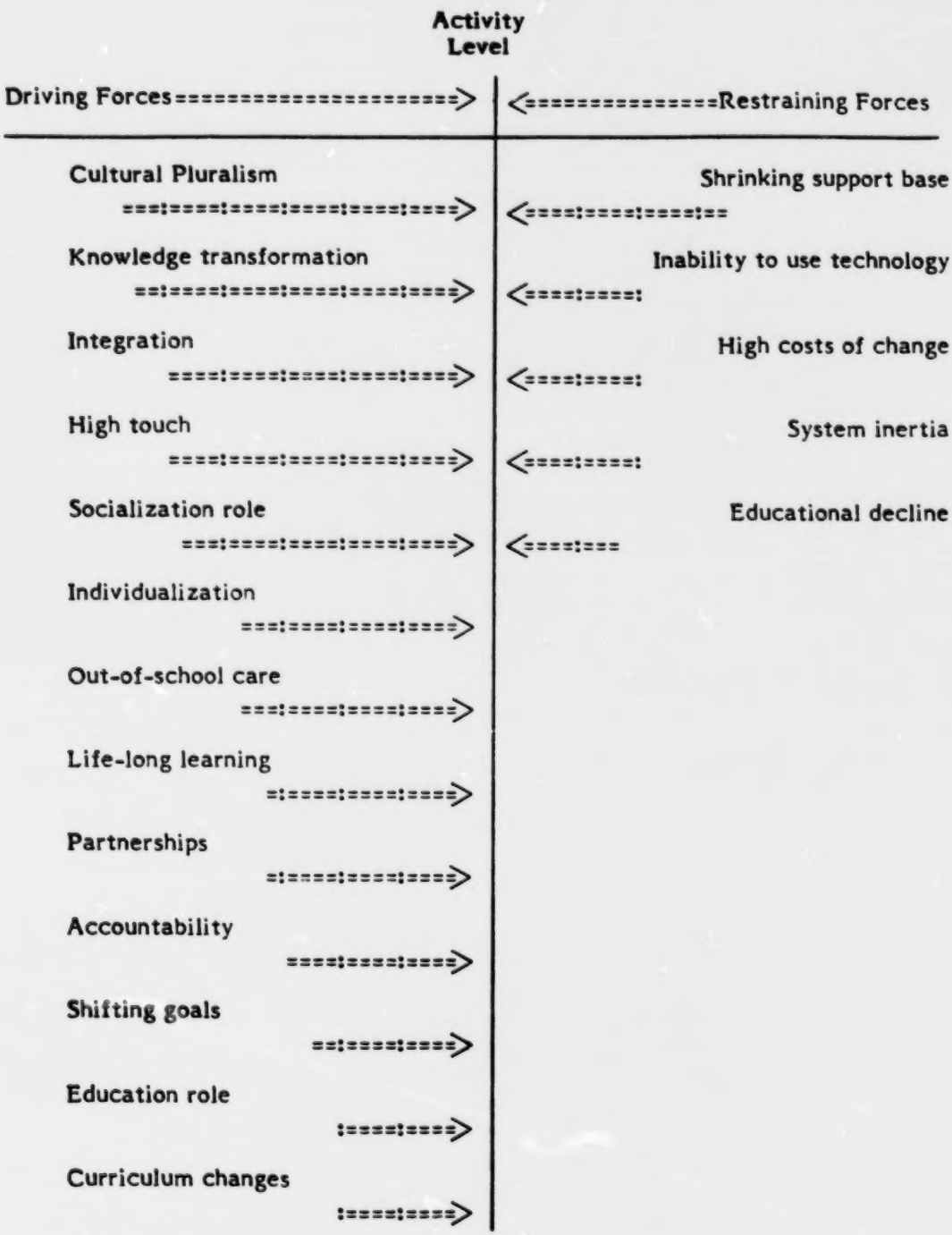
Up to now the discussion has focussed on changes to education and educational delivery as a step to understanding what educational facilities should be like in the future. There are some other factors appearing on the horizon that may significantly influence both the kinds of facilities that are built in the future and how they are built. Several of the more obvious of these factors are discussed.

Figure 10. Force Field Analysis of Factors Associated With the Authoritarian Scenario



The following factors were perceived by an ad hoc review team to be neutral with respect to the Authoritarian Scenario: increasing educational costs, socialization role, shifting goals, curriculum changes, life long learning, need for highly skilled workers, out-of-school care, cultural pluralism, integration, inability to use technology, high touch, shrinking support base, and the custodial role.

Figure 11. Force Field Analysis of Factors Associated With the Ecological Scenario



The following factors were perceived by an ad hoc review team to be neutral with respect to the Ecological Scenario: societal values, competition, need for highly skilled workers, vested interests, structural unemployment, technology, custodial care, economic turbulence, and increasing educational costs.

Learning Environments. Ferguson (1980: 290) notes that classrooms in the past were designed for efficiency and convenience. Classrooms in the future should focus on a high quality learning environment and should consider: lighting, color, air, physical comfort, need for both privacy and interaction, and for both quiet and exuberant activities.

Light, for example, is coming to be seen as more important to the overall environment than had been previously the case. One of the outcomes of the New York Academy of Science conference on the medical and biological effects of lights, held during November 1984, was acknowledgement that light is a key to general well-being, and of special significance, for those who are confined to built environments most of the time, e.g. office workers and school children. In this regard, a recently completed study in Alberta suggests that trace amounts of ultraviolet radiation incorporated into regular classroom lighting significantly reduces the development of dental cavities and contributes to improved health, an apparent enhanced sense of well-being and improved attendance (Wohlfarth, 1986).

Competition For Resources. Non-renewable resources are coming into short supply and it may be expected that both competition and conservation will be the theme in the future. Included among these resources are (or will be) oil and gas, water, pure air, green areas, and possibly land (they aren't making any more) (Communications Era Task Force, 1984: 7).

New Materials and Processes. New materials and new processes are constantly appearing in the market place. A number of these have implications for educational facility planners and designers. Robotics, for example, might be explored to determine the extent to which robots may be used in the operation of facilities, in cleaning and custodial care, security surveillance, and storing and retrieving supplies and materials. Microprocessors might be used in many ways in ensuring that the facilities are always operating at peak efficiency -- the technology appears to be available to enable design of truly "smart" facilities. Fiberoptic light ducts and solar concentrators might be used to bring natural light into the cores of large buildings.

Multiple Uses Of Facilities. Regardless of the image of the future chosen for pursuit, there is an undercurrent of opinion which suggests that public facilities may have to change uses over their life cycles. Accordingly, one can anticipate that there may be shared or concurrent joint uses and there may be different uses and users over time.

The facilities should be designed for adaptability and facility planners should seek ways of involving appropriate stakeholders and funding agencies at the right points in the overall facility planning and design process.

Accidental Disaster, Social Strife and Terrorism. While the western world has not been torn by terrorism to the same extent as other parts of the world, the potential (though remote) does exist for it to happen anywhere. Transportation systems, power grids, communication lines, water and food supplies are all vulnerable to terrorists. More importantly, there have been a number of instances of accidents that produce life-threatening situations in communities (train derailments, gas line explosions, Three-Mile Island, the chemical spill in Bhopal, India, the Chernobyl disaster, and so forth) and they serve as reminders that this treat is often not far away. Unpleasant as the prospect may be, there may be a future

need for some community facilities to serve as survival centres and to have the capability for maintaining operations, rendering aid during man-made (or natural) disasters and for providing back-up emergency reserves of water, food, and other emergency supplies.

Implications of Scenarios

These scenarios have implications both for education and for educational facilities. Each is considered separately.

Implications for Education

It is not apparent that any one of the scenarios discussed so far is clearly the more probable image of the future -- each is possible. There are signs which suggest that the factors required to advance each scenario are present in society today. It is useful to summarize:

1. The superindustrialization scenario and the authoritarian scenario, at least to some extent, lack a warm and human dynamic. This may give individuals an even greater sense of lack of control in their lives (anomie). Any resulting alienation may be reflected in increases in the incidents of rebellion and violation of basic social codes -- the increase of anti-social behavior. The ecological scenario would, on the other hand, work to counter this trend. Accordingly, for this reason and because it is most compatible with the interests of educational institutions and teachers, aspects of the ecological scenario may be expected in the future. Nevertheless, many elements of the other scenarios will also be incorporated into education in the future.

2. The public school system may be in a decline (if one looks only at the declining SAT scores and the increase in the number of private schools). The decline of public schools may be hastened by the entry of the private sector into the educational arena with franchised learning systems or educational delivery systems. Technology also has the potential to link children in front of their living room TV set with some of the best educators and educational experiences in the world. If the half-life of an education is five years and the average experience level of teachers is ten to twelve years, then it would appear that many teachers are using a somewhat obsolete set of educational theories and knowledge bases. Indeed, schools may not be able to change fast enough to withstand the pressure for educational change.

3. Societal survival in the future may be contingent on new specifications of literacy and new sets of basic knowledge. Creativity, individual initiative, enterprise and the ability to acquire and utilize information may become the new basics of education.

4. "Grey power" will increase as the overall population ages and birth rates decline, with the result that the support base for public education may decline.

Having come this far, it is now easier to develop an image of the future which is perhaps more plausible than any of the scenarios considered so far. It is the "composite" scenario -- a scenario based on the best of each of the other scenarios. Figure 12 graphically describes the "composite" scenario.

The pressures for educational change from all sources that are contained in the reservoir behind the dam could be channeled in such a way as to relieve the pressure on the dam -- the educational status quo. This could occur in two ways: the dam could be bypassed or the dam could be modified or restructured to provide a controlled spillway. These choices are critical, however. If the bypass alternative occurred, it could be as the result of a significant increase in competition for the educational status quo. On the other hand, restructuring of the dam itself (educational reform) could lead to an enhanced and strengthened educational system.

Implications for Educational Facilities

One of the most significant implications for educational faculty planning is the scope the planning must encompass. Education is only one of a number of social programs that could benefit from broadened planning perspectives. Indeed, it may be naive to think about facilities exclusively for a specific program. Perhaps facilities should be designed to serve several programs or to meet several societal needs simultaneously. Figure 13 (based on Henchey, 1986b) describes a process that may be followed in planning facilities to meet educational needs.

The essence of the framework in Figure 13 is that educational facility planning should begin with some attempts to study the future and to develop one or more scenarios. The preferred scenario is then analyzed for potential social policies and social plans. Policies may be narrow and focus on education or they may be broad and span a number of social programs. The preferred mode would be to consider education within the context of other programs. When that approach is followed it becomes easier to plan facilities that naturally serve multiple needs.

As the focus of planning narrows to the educational domain, Henchey (1986b) proposes a useful set of guidelines or parameters for the planning process. He contends that facility planners should:

1. Balance rapid, continuous and erratic change with some elements of continuity, stability and calm.

2. Regard learning as associated with all (or most) stages of life, with several institutions (e.g. schools, colleges, universities, and workplaces), and for a variety of purposes (e.g. vocational preparation, leisure and personal interest, custodial care).

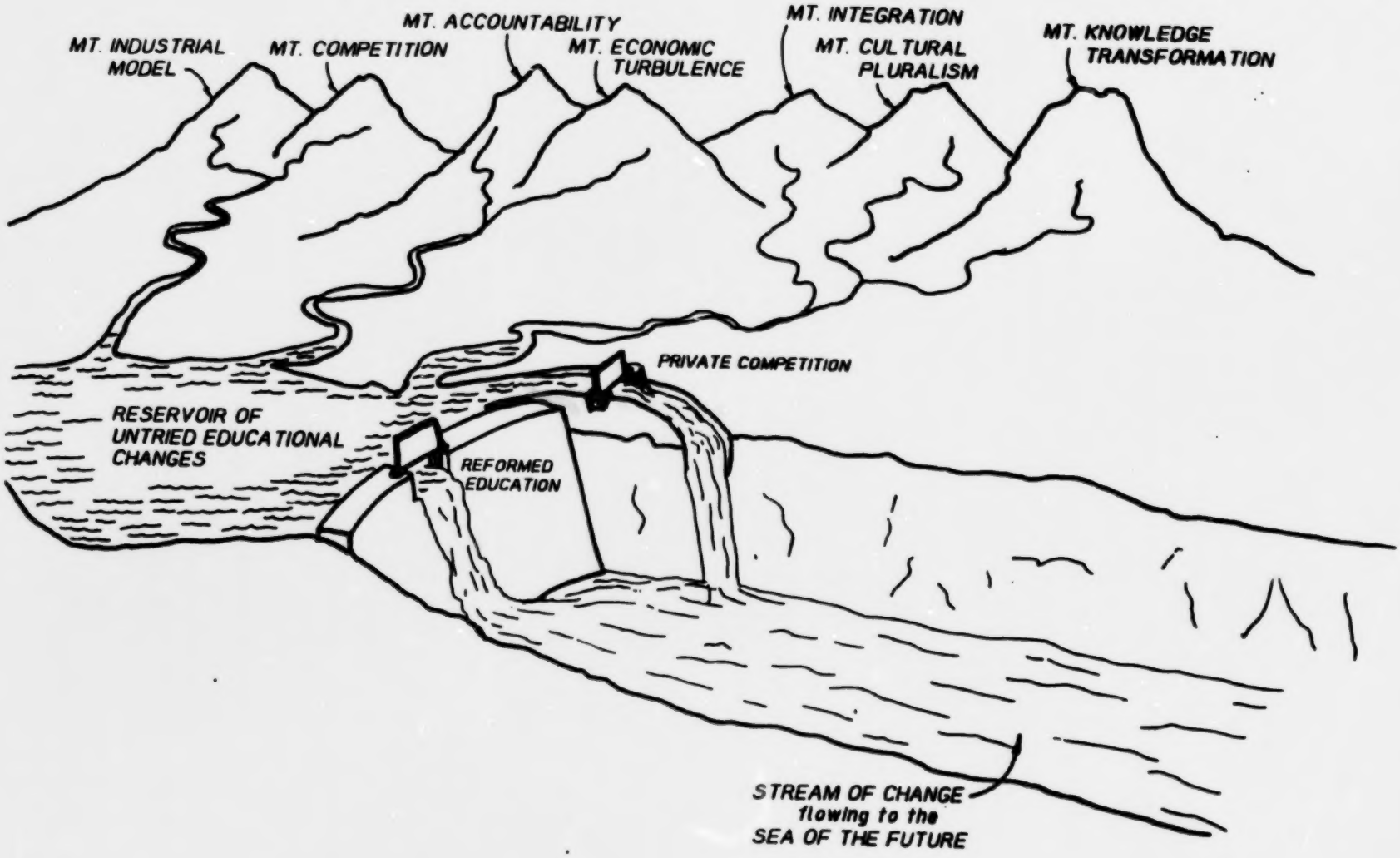
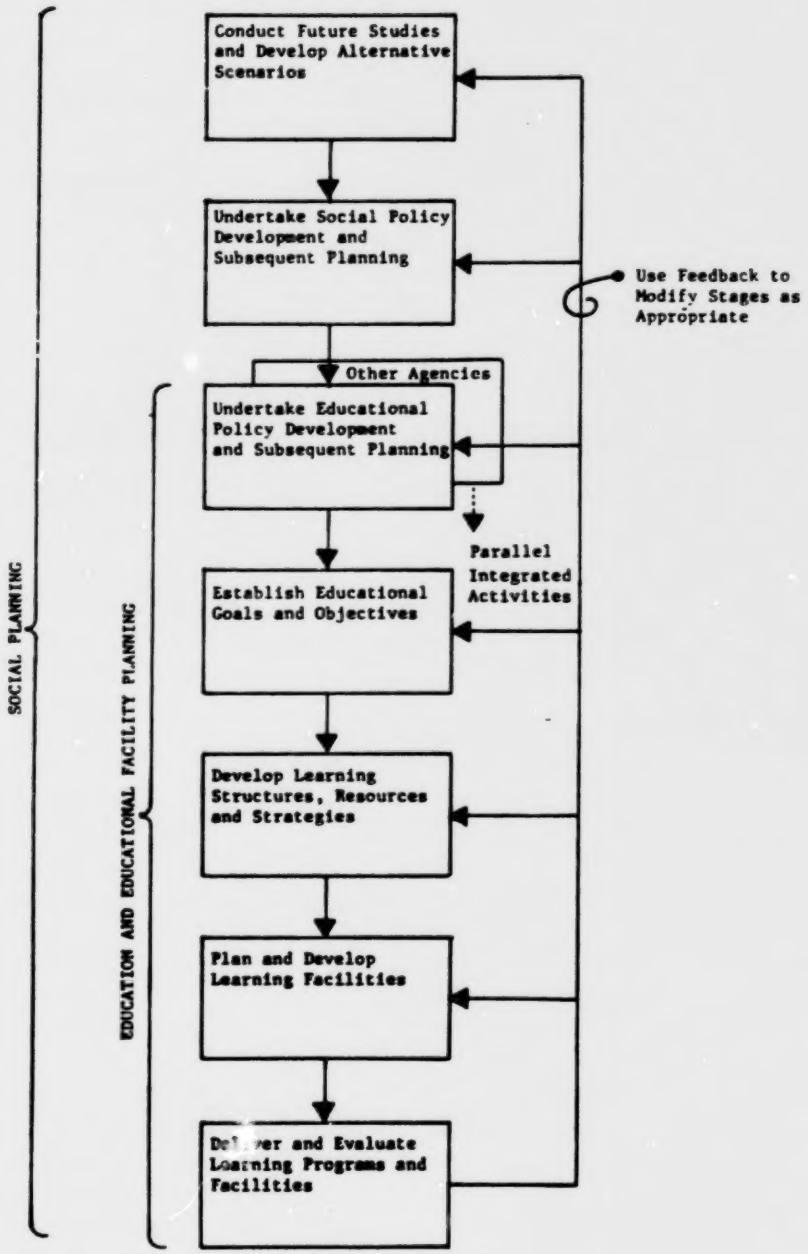


Figure 12. A Description of The Forces and Factors Influencing a Composite Scenario

Figure 13. The Macro Social Planning Process



3. Recognize that advances in communication technology and brain research are broadening our conception of how learning takes place.

4. Recognize that the physical and human environments have an impact on the social climate, culture and ethos of the learning environment.

5. Recognize that present learning environments reflect not only the present society but also project alternative future images (e.g. dynamism, leadership, freedom of choice).

6. View the educational system as including a formal dimension (elementary, secondary, post-secondary levels) and a non-formal dimension (libraries, video clubs, museums, business and industrial learning programs, information networks, churches, voluntary organizations, community activities, and the media.

Finally, the broad view of educational facility planning should include a framework which ensures that decisions are made which satisfy the greatest array of societal needs. Here too Henchey (1986b) offers some insights. Decisions about educational facilities are usually of the following types: decisions to provide new facilities; decisions to provide alternative facilities to meet the various client needs; decisions to adapt educational facilities to other purposes; and decisions to retire existing facilities.

Decisions in the last three categories (and possibly in all categories) may best serve public policy if they recognize the concurrent need for:

(a) custodial institutions for child care and care of the aged, both combining supervision, services, and learning stimulation; it may be linkages between child-care and elderly-care facilities can be strengthened, with staff moving back and forth between them;

(b) resource institutions built around unusual, costly, or complex resources, on the model of a museum or library, linked with other resource centres through information networks, and providing points of access for the public; such centres would combine special technological resources (e.g. computer-based learning programs, simulation activities), cultural resources (art), and person-based resources (artists musicians, writers, scholars, artisans, master teachers); and

(c) service institutions offering individual and group learning programs, structured in a variety of ways, as well as evaluation and certification services.

Some of these facilities will be linked to other people institutions (day care, old-age care, health facilities), integrated into private organizations (service centres for managers within a business), facilities within other designs (office towers, shopping malls, apartment complexes), or extensions of media (communications networks and computer facilities). Some will have public funds and control, some will be private and not for profit, and some will be profit oriented (franchises).

The focus can now shift to a number of issues and implications that these scenarios raise for educational facility owners and planners (the people who plan educational facilities, those who design them, those who build them, and those who maintain them). To answer the following questions, the reader must make his or her own interpretation of the significance of each of the scenarios and of the probability of their occurrence. Moreover they must be addressed from different perspectives, e.g. elementary, secondary and post-secondary education.

1. The notion of scarce resources which tends to run through all scenarios suggests that there may have to be some creative ways of providing educational facilities over the case at present. Consider that we still build educational facilities on expensive tracts of land yet we use them only 1000 and 1200 hours per year. This amounts to usage for about 15 percent of the totally available time.

- o How can the utilization rates of educational (or other) facilities be increased?

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2. Educational facilities in the future may be used for an expanded inventory of activities. In addition to the regular educational program they could be used to provide: re-education facilities for the community, out-of-school care facilities on a 24 hour basis, emergency shelters in time of disaster, community recreation, or some combination of all of these.

- o How can educational facilities be designed to accommodate multiple uses and users both concurrently and sequentially during a day or a year?

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3. In order to provide educational facilities or education centres where the people are located, it may be necessary to enter into partnership arrangements with owners of apartments, retail complexes, or other entities.

- o How can educational facilities be integrated with other types of facilities and uses?

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4. Because educational facilities may not always be needed for education, there may be a need to plan educational facilities with some alternative future use in mind. These future uses may also make it necessary to deal with a number of different agencies, for example, the future owners, the municipal people (who presently zone for schools rather than multi-use zoning), and funding agencies.

- o How can educational facilities be made more readily adaptable to multiple future uses?
- o How can cooperative planning and long-range decisions be made with respect to multiple users over the life of a building?
- o How can the various stakeholders be identified and brought together early to carry out the necessary planning?
- o How should funding be handled at the outset and later as the use of the facilities change?

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5. Technology, or other factors, may make the educational facilities we are all accustomed to obsolete.

- o What type of facilities would it take to deliver the individualized high technology education that is possible and yet retain the high touch atmosphere that most people need?

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6. Resources such as fuel, water, pure air, green space and land may become significantly scarcer in the future.

- o How can educational facilities be planned, designed and built to conserve scarce resources?

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7. Robotics and technology offer great potentials for facility management, operation and control.

- How can technology and robotics be employed to enhance the operation and maintenance of educational facilities?

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8. Ferguson (1980: 290) suggests that the learning environment should consider: lighting, color, air, physical comfort, space for privacy and interaction, and space for quiet and exuberant activities.

- How can Ferguson's criteria be incorporated into educational facility design effectively and efficiently?

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9. Unpleasant as the prospect is, it may be worthwhile to briefly consider making some public facilities disaster proof. The results of industrial accidents, social strife or terrorism in communities could place great demands on schools and other public buildings to provide refuges, shelters and emergency supplies and support systems.

- How can educational facilities be planned, designed and built to withstand the threats of disaster and terrorism and capable of providing a continuing service if they should occur?

- Can facilities be cost-effectively designed with sensors capable of sealing buildings in the event of air-or water-carried threats to occupants?

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10. This paper has identified five possible scenarios (superindustrial, authoritarian, ecological, crisis and composite). Each has a possibility of occuring in the future.

- Which would be the preferred scenario and what is the best strategy to follow in getting there?

- What could educational facility planners do to hasten or hinder the unfolding of the preferred scenario?

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